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Everett

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(54) **TANGO II SOIL BLOCK PRESS**

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(51) **Int. Cl.**[7] **B28B 3/08**; B28B 7/10

(52) **U.S. Cl.** ..... **264/109**; 264/40.5; 264/297.9; 264/319; 264/334; 425/62; 425/352; 425/354; 425/436 R; 425/139; 425/149

(58) **Field of Search** ..... 425/62, 352, 354, 425/167, 165, 149, 139, 436 R; 264/40.5, 319, 333, 297.9, 334, 109

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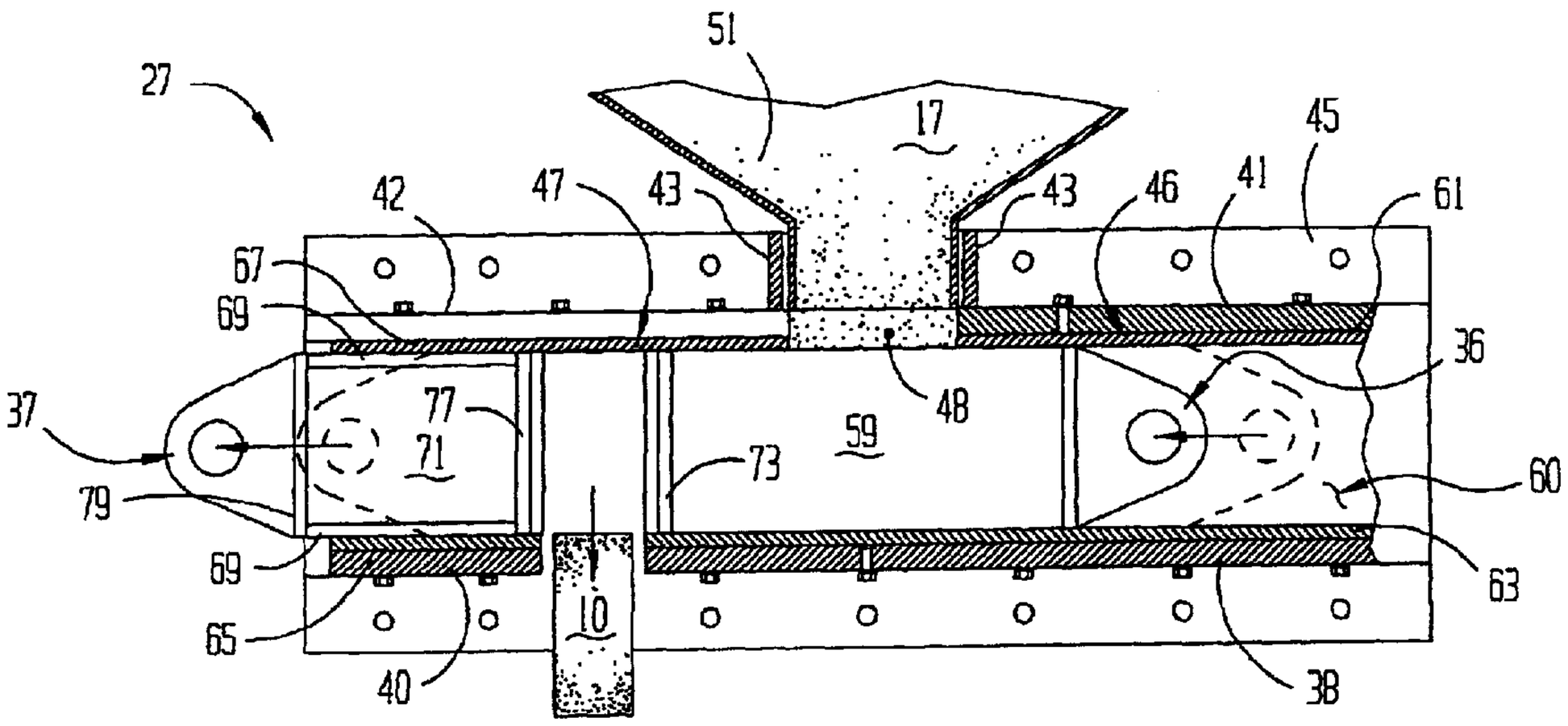
(57) **ABSTRACT**

A portable single station method and apparatus for compressing a quantity of freshly dug soil into building blocks by an enclosed system which provides a linear process for receiving and compressing the quantity of soil and for ejecting the formed, compressed building blocks. The system includes a stationary chamber equipped with an internal adjustable cavity in which the desired block is formed and a pair of opposing pressure heads capable of moving toward and away from each other in unison or independently to receive, compress, and eject the building blocks.

12 Claims, 7 Drawing Sheets



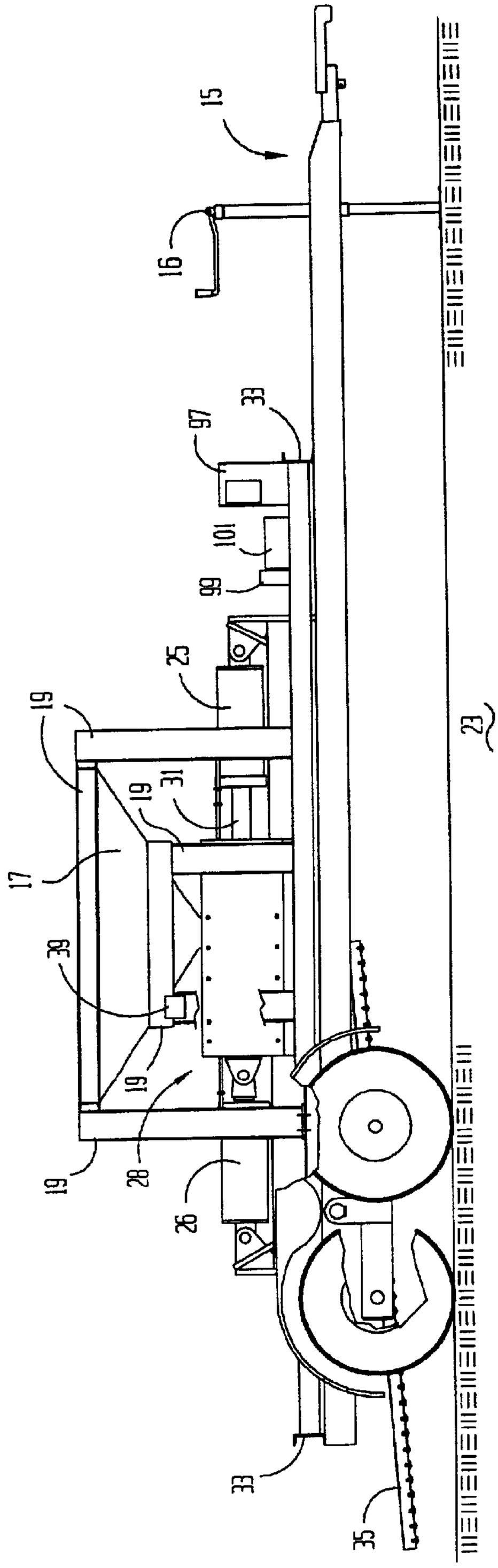


FIG 1

FIG 2

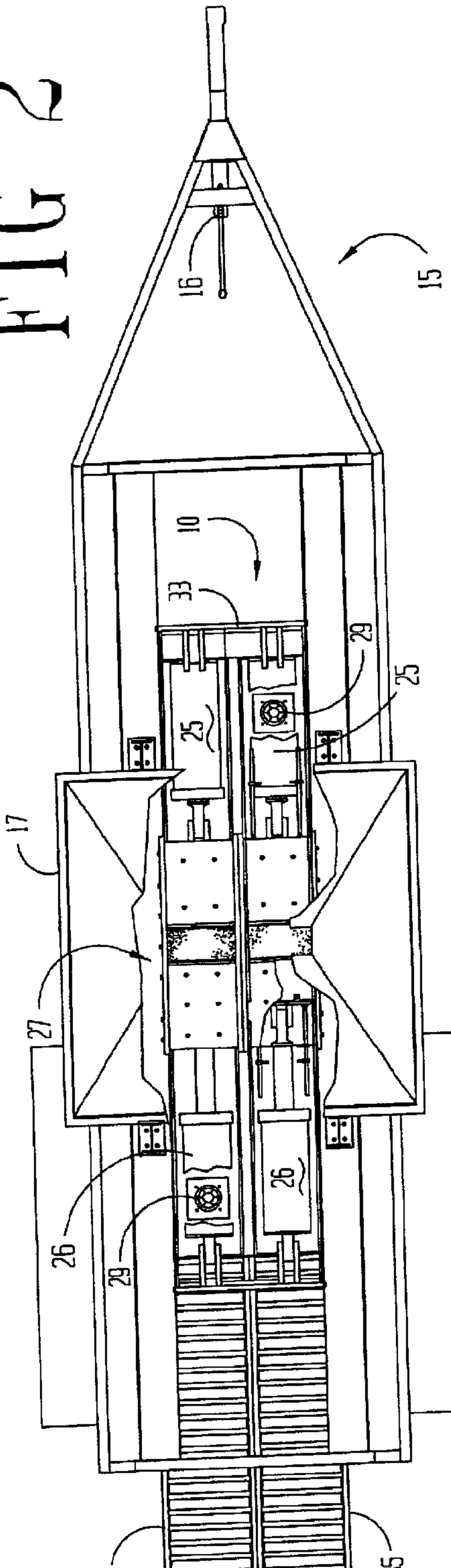

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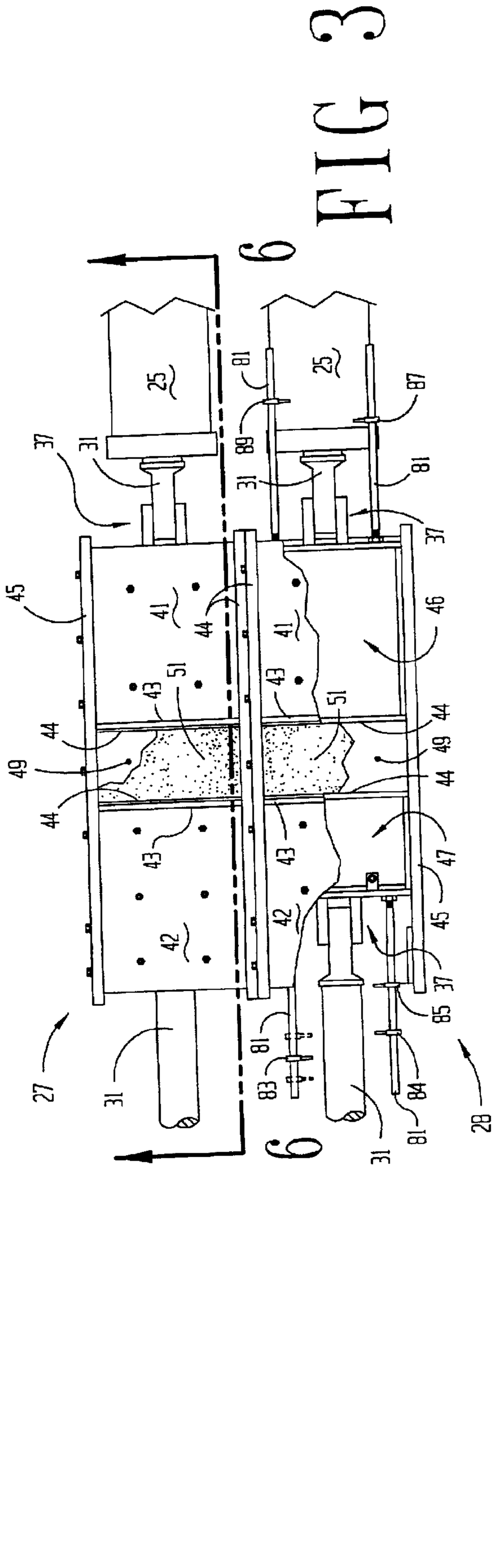
FIG 6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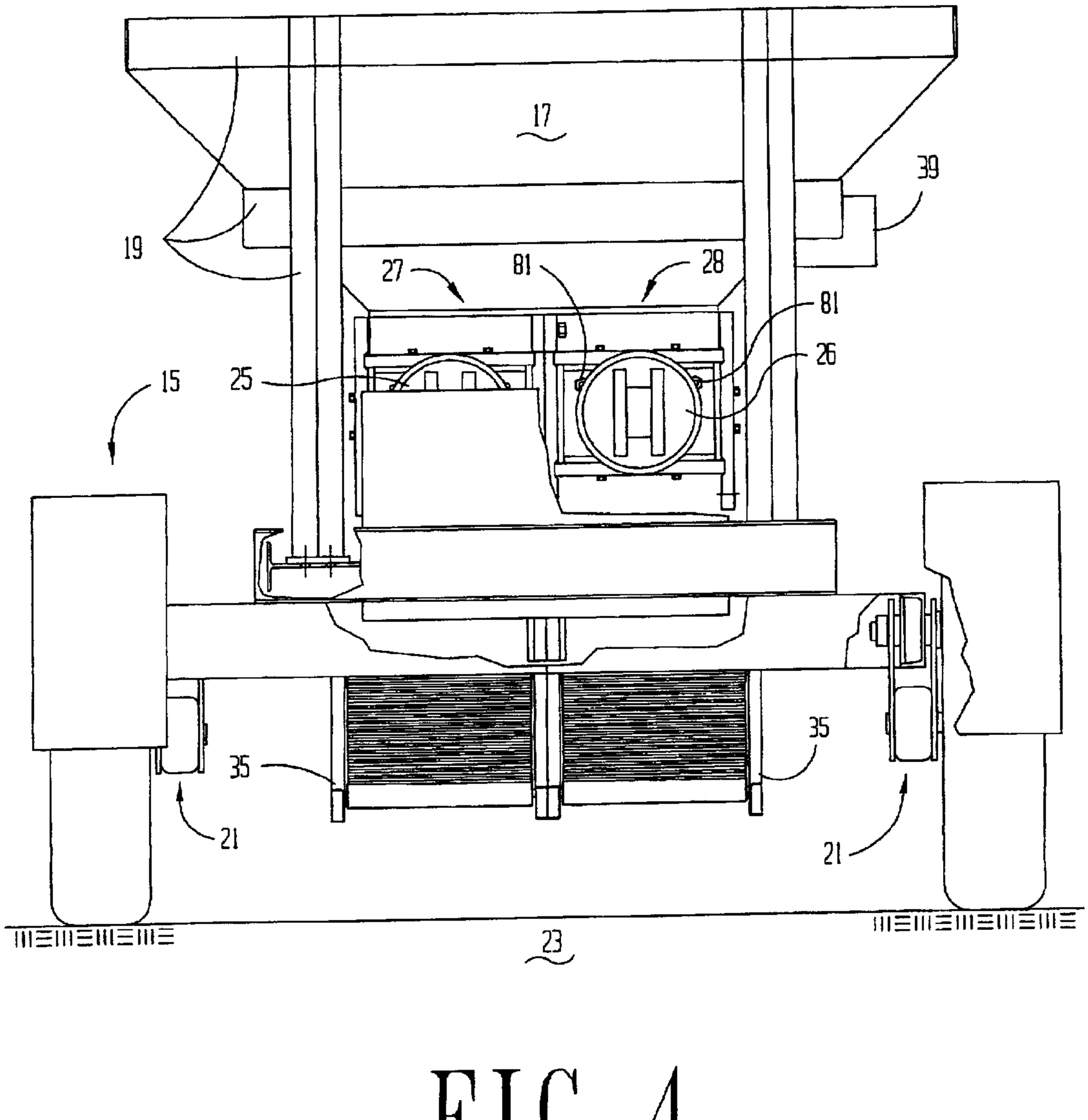

FIG 4

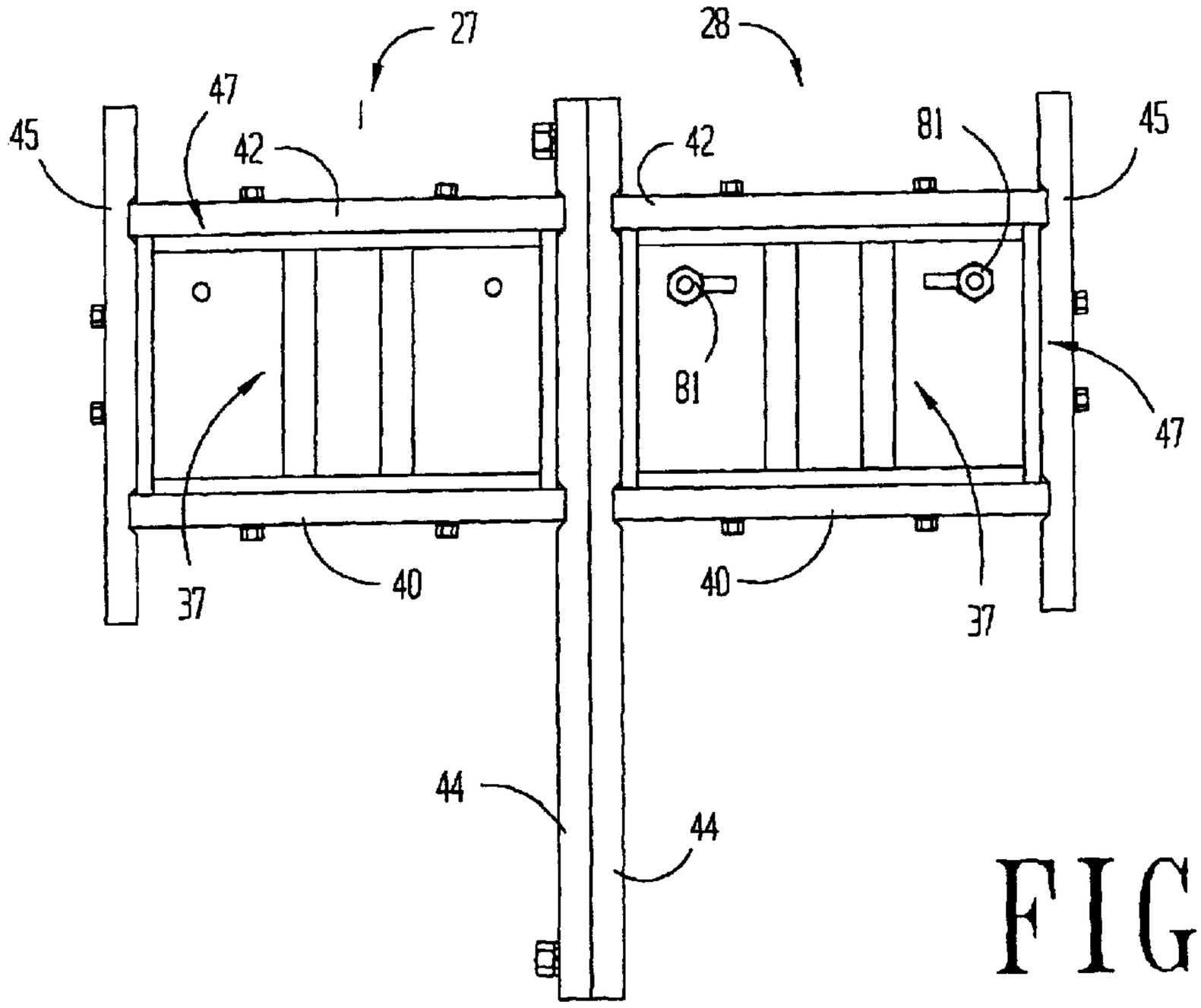
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FIG 5

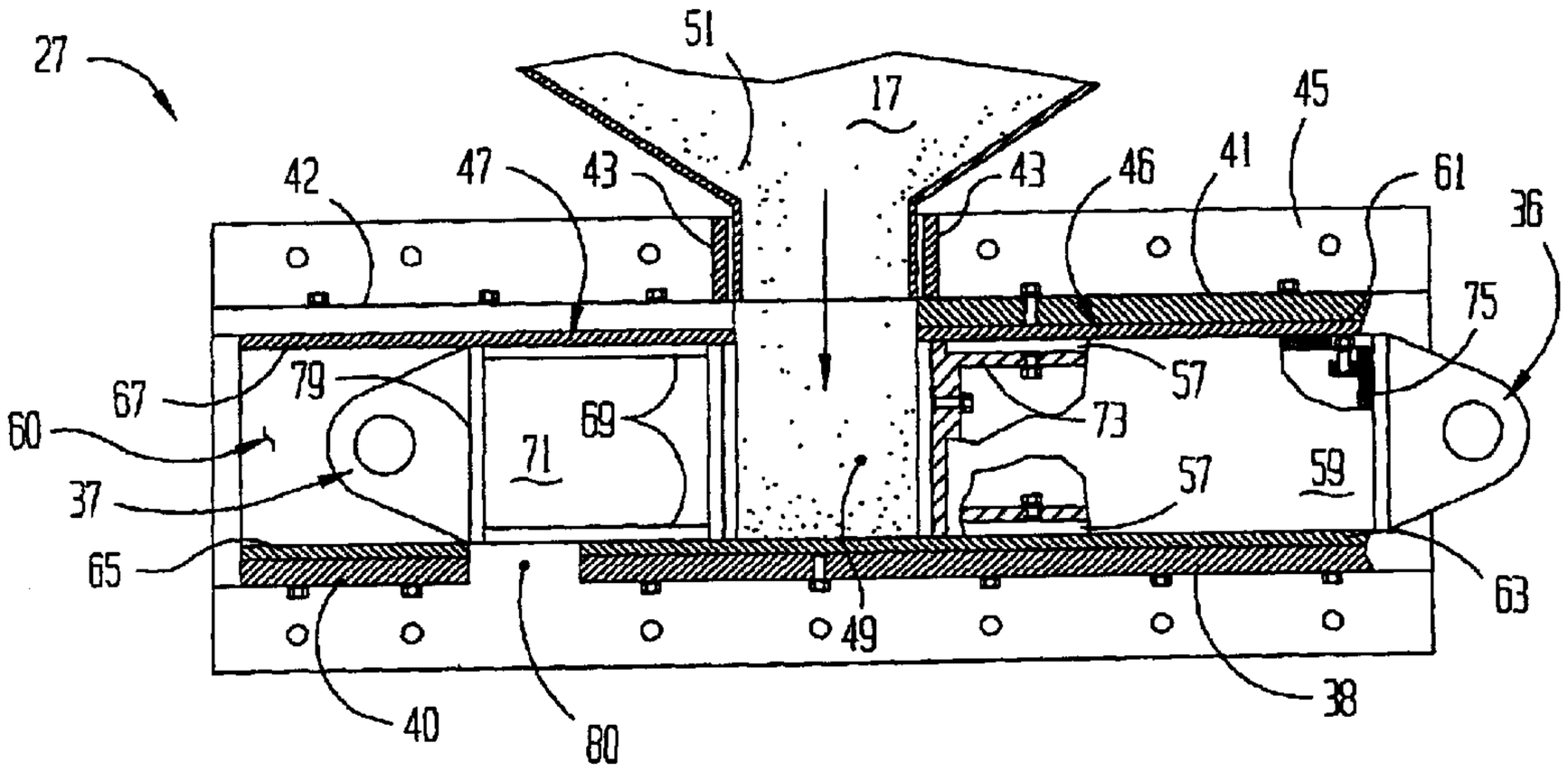
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FIG 6

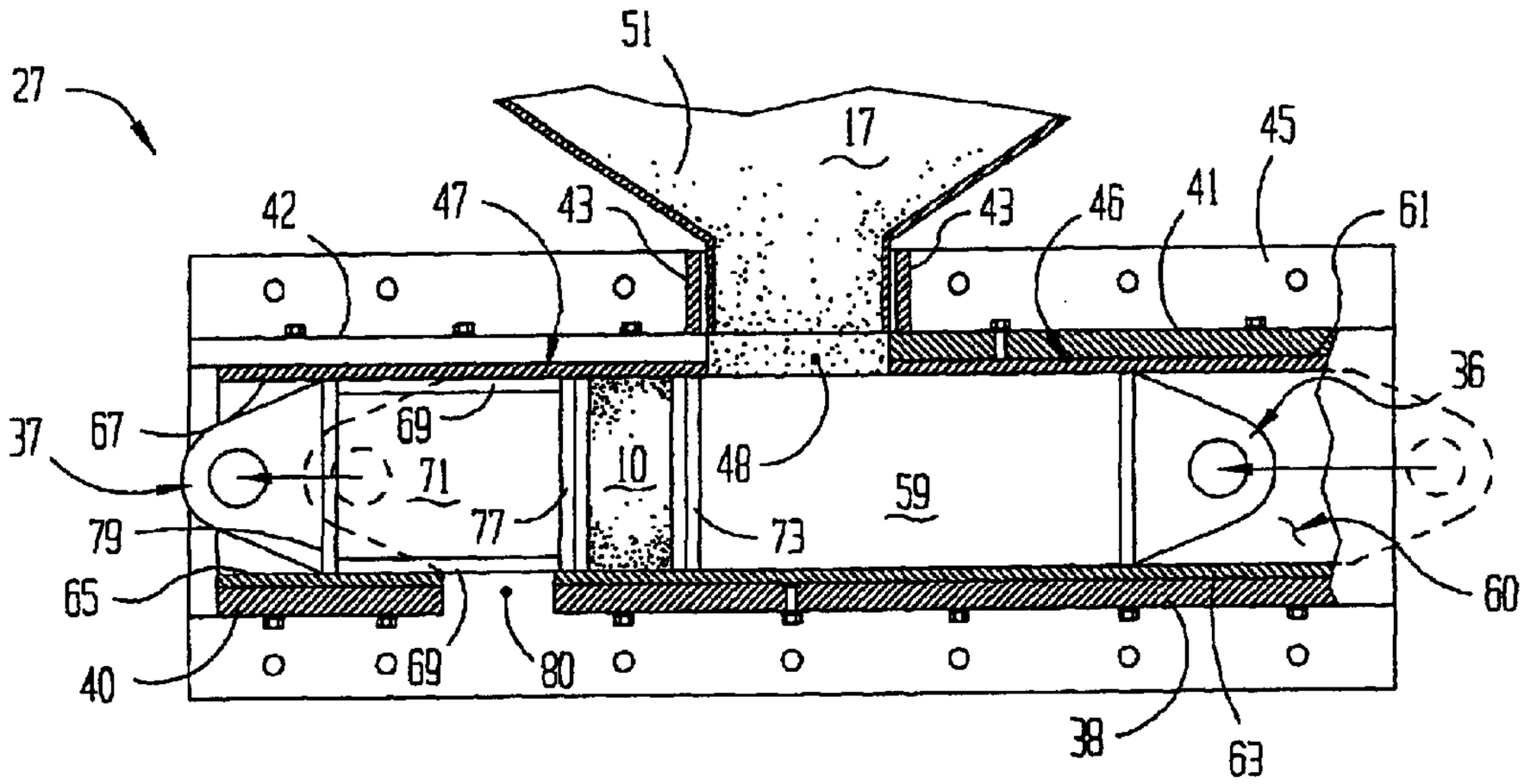
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FIG 7

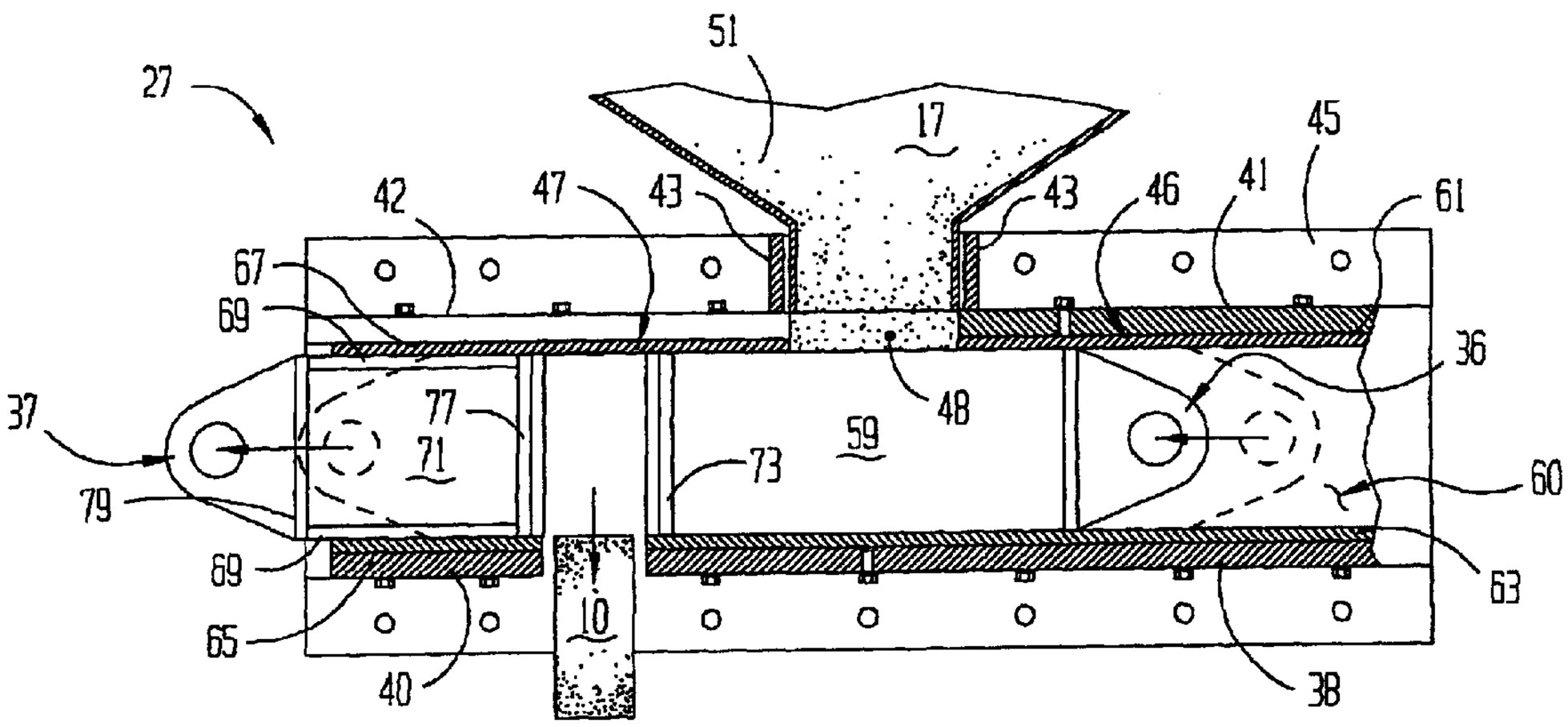
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FIG 8

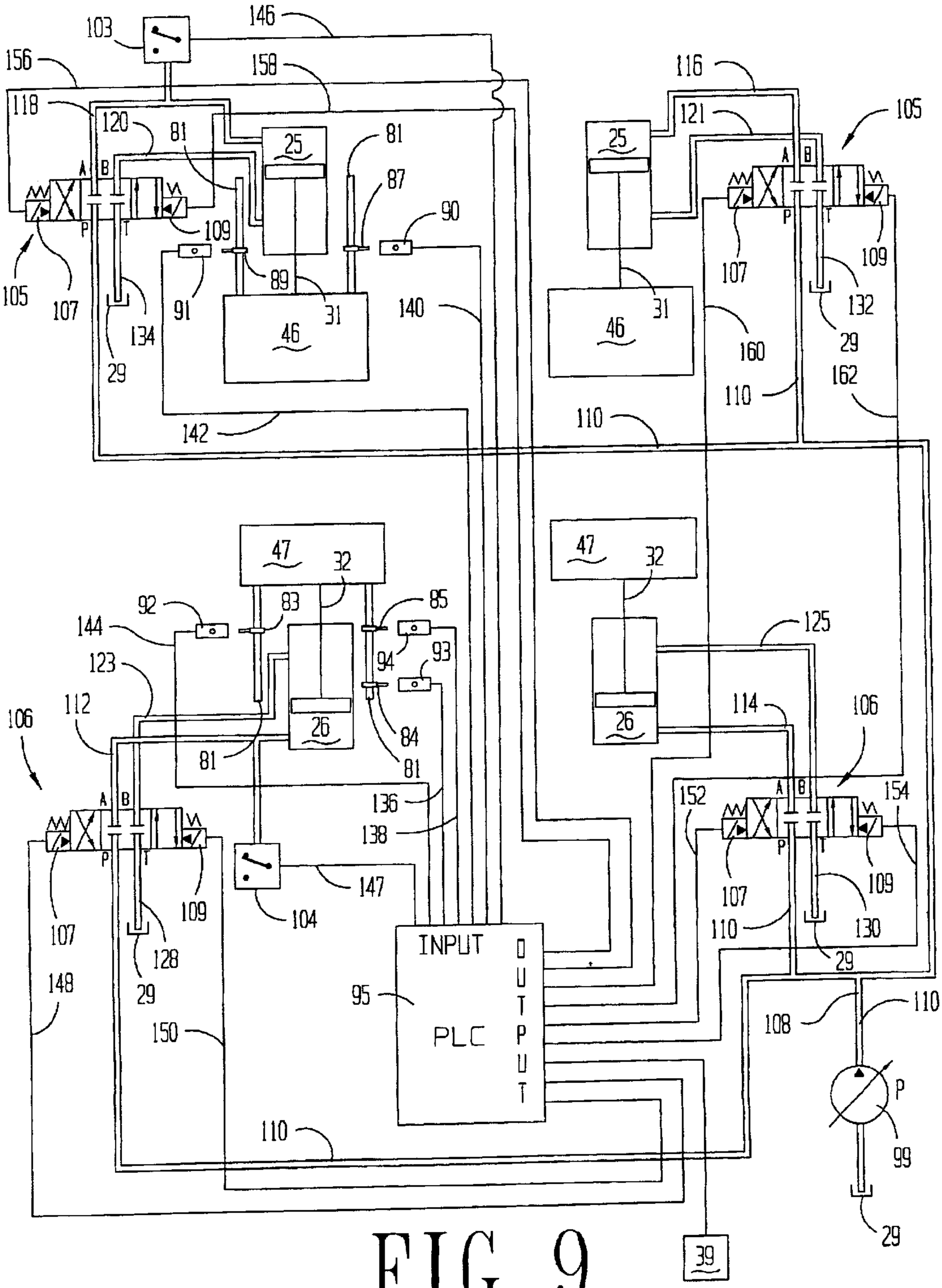
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FIG 9

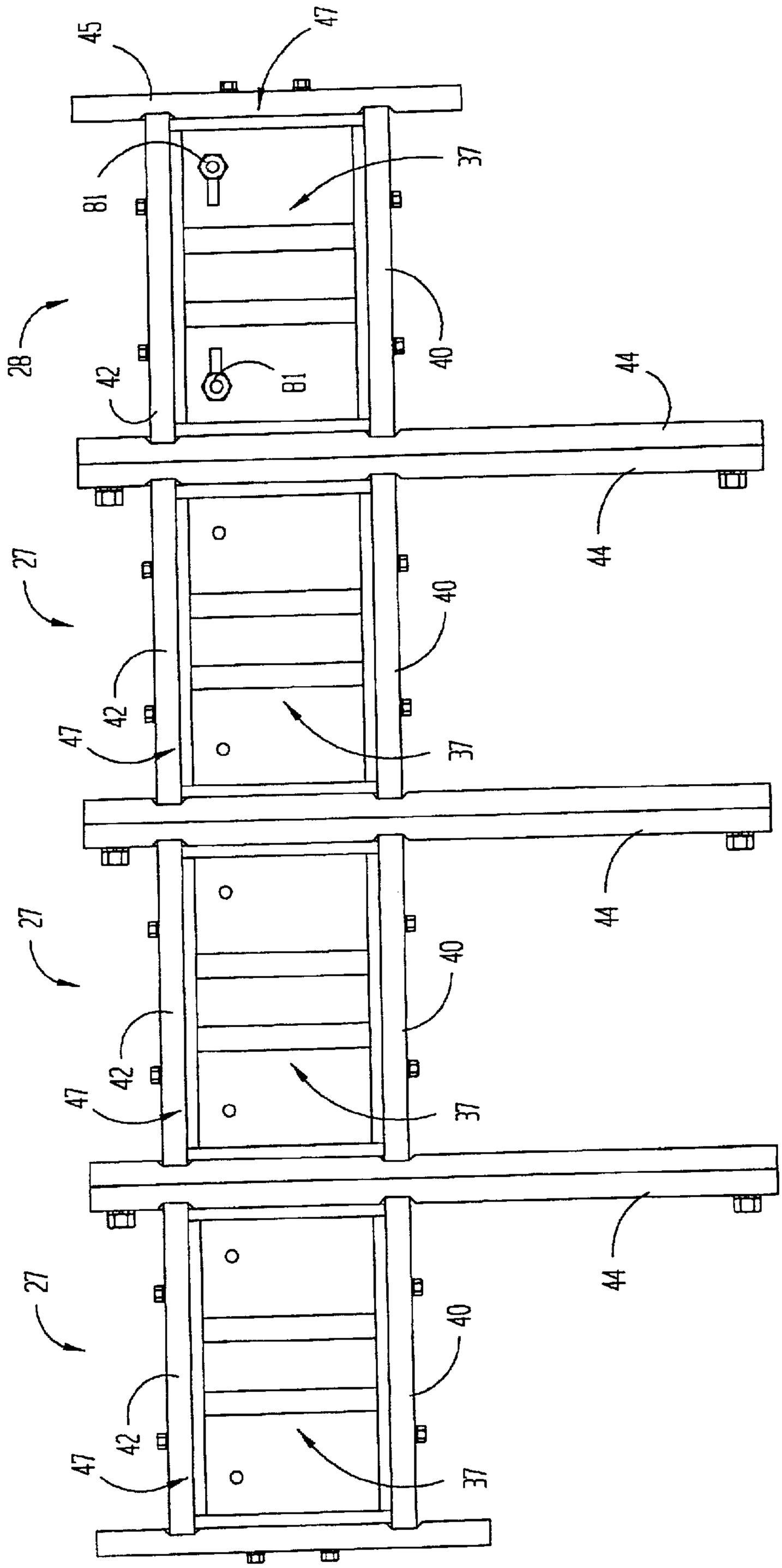
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FIG 10

TANGO II SOIL BLOCK PRESS

This application claims the benefit of Provisional application No. 60/266,371 filed Feb. 5, 2001

FIELD OF THE INVENTION

This invention relates to a linear self-enclosed apparatus for compressing freshly dug soil into compressed blocks suitable for the creation of a structure.

BACKGROUND OF THE INVENTION

The formation of building blocks from soil and clay is a well known process utilized throughout the world. Throughout the years various applications designed to automate this process have been produced. Previously designed apparatus, however, have involved complex mechanical procedures. A need exists for a design and process in which building blocks of different sizes and thickness can be formed simultaneously. An additional need exists for a design which allows for two or more systems to be joined and operated simultaneously or independently, while maintaining an easy access to replaceable components.

Examples of previous known form of presses similar to the present invention are disclosed in U.S. Pat. Nos. 4,640,671; 6,224,359.

SUMMARY OF THE INVENTION

The main objective of this invention is to provide a new and improved linear building block forming apparatus which is self-contained and capable of receiving a quantity of soil, forming building blocks of adjustable dimensions uniformly, and ejecting said blocks within a single multiple function case.

It is also an object of the invention to provide a new and improved linear building block forming process that is linear and contained within a multiple purpose case.

It is also an object of the invention to provide a new and improved linear building block forming process in which opposing compression heads are moved toward and away from one another with the purpose of receiving an adjustable quantity of soil, moving said soil, compressing said soil into a block and ejecting a compressed soil block.

It is also an object of the invention to provide a new and improved linear building block forming process in which opposing compression heads are moved toward and away from one another by any mechanical means.

It is therefore an object of the invention to provide a new and improved linear building block forming apparatus that may be mounted on a trailer chassis and may be towed to the site of construction.

It is another object of the invention to provide a new and improved linear building block forming apparatus that will create building blocks of different plan sizes utilizing a heavy textured clay, preferably without any addition of moisture or binder material with minimal skill or effort from the operator.

It is the objective of the invention to provide a new and improved linear building block forming apparatus that will compress the soil under high pressure to produce a building block so dense when ejected from the multiple function case that it will be instantly ready for use and need not be cured before use.

It is a further object of the invention to provide a new and improved linear building block forming apparatus that is modular in nature to allow for the addition of one or more multiple function cases, which may be controlled simultaneously or independently.

It is therefore also an object of the invention to provide a new and improved linear building block forming apparatus that is modular in nature to allow for higher production yields or to allow for production of blocks of different dimensions simultaneously or independently.

It is also an objective of the invention to provide a new and improved linear building block forming apparatus that produces uniform blocks dimensionally of adjustable sizes, which can be used to construct a structure by progressively dampening the upper course of the structure with water or light mud slurry, and placing the next course directly on top of this course.

It is still another object of the invention to provide a new and improved linear building block forming apparatus that is of durable construction.

It is also another object of the invention to provide a new and improved linear building block forming apparatus that requires low maintenance and is easily serviced.

It is yet another object of the invention to provide a new and improved linear building block forming apparatus that can be assembled and operated with a minimal of skill and attention.

It is still a further object of this invention to provide a new and improved linear building block forming apparatus that loads soil into the soil receiving area of the multiple function case efficiently and in a more compacted state by the use of a high-frequency vibration apparatus mounted directly to the soil receiving hopper.

These and other advantages, features and objects of the invention will become more apparent from the following description taken in connection with the illustrative embodiment in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side lateral view of a four wheel mounted trailer form of the instant invention;

FIG. **2** is a top view of the invention mounted atop a four wheeled trailer chassis in which the soil hopper and a pair of hydraulic actuators have been fragmented to illustrate the multiple function case;

FIG. **3** is a partially fragmented top view of the multiple function case in which the compression heads and hydraulic actuators are more clearly illustrated;

FIG. **4** is a partially fragmented rear view of the invention mounted atop a four wheeled trailer chassis;

FIG. **5** is a rear lateral view of the invention showing a pair of multiple function cases, in which one contains a positioning control apparatus, which have been joined together about their corresponding connecting panels;

FIG. **6** is a sectional view taken about line **6—6** in FIG. **3** showing the locations and positions of the soil hopper, adjustable compression heads and their components, multiple function case and its components, and loose soil prior to compaction;

FIG. **7** is a partially fragmented side lateral view of the multiple function case showing the movement and positions of the compression heads, multiple function case and its components, compressed soil block and loose soil at compaction;

FIG. **8** is a partially fragmented side lateral view of the multiple function case showing the movement and positions

of the compression heads, multiple function case and its components, compressed soil block and loose soil at the moment the compressed soil block is ejected from the multiple function case;

FIG. **9** is a fragmentary diagrammatic view illustrating the manner in which the hydraulic actuators may be controlled for the purpose of achieving desired compression between compression heads, and

FIG. **10** is a rear lateral view of the invention showing a plurality of multiple function cases, in which one contains a positioning control apparatus, which have been joined together about their corresponding connecting panels.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more specifically to the drawings, the numeral **15** generally designates a trailer frame which may be towed behind a towing vehicle (not shown) and which includes a pair of wheeled axle assemblies **21** and **22** on its rear end as well as a jack structure **16**. The jack structure **16** may be utilized in order to stationarily support the trailer frame **15** from the ground **23**.

The trailer frame **15** supports a case support frame **33**, a hydraulic tank **29**, a programmable logic control (PLC) unit **95**, a control panel **97**, a hydraulic pump **99**, an electrical motor **101**, a pair of roller conveyors **35**, as well as a hopper support frame **19**.

As seen in FIGS. **1** and **4**, the hopper support frame **19** contains the soil hopper **17** positioned above the pair of multiple function cases **27** and **28**, in a stationary position.

Said soil hopper **17** is supported by a pair of braces **43** about its discharge area.

The case support frame **33** supports a pair of multiple function cases **27** and **28**, each with a pair of hydraulic actuators **25** attachable at a point generally referred to by the numeral **37** as seen in FIGS. **2** and **4**.

The multiple function cases **27** and **28** are representative of a possible combination whereby both cases will function in unison to create compressed soil blocks uniform in size, thickness, and density (See FIG. **3**). As illustrated in FIG. **5**, the multiple function cases **27** and **28** are symmetrical about their connecting panels **44**.

As is illustrated in FIGS. **3**, **5** and **6**, the multiple function cases, **27** and **28**, are composed of compression heads, generally designated by numerals **46** and **47**, side cover panels **45**, connecting panels **44**, upper covers **41** and **42** and lower covers **38** and **40**. As can be seen in the previously mentioned FIGS., the upper covers **41** and **42**, along with bottom covers **38** and **40** and panels **44** and **45** are joined to form an enclosed area. Said enclosed area contains two apertures designated by numerals **48** and **80**. It is within said enclosed area that a compression case area, generally designated by numeral **60** is formed. Within said compression case area **60** compression case wear plates **61**, **63**, **65** and **67** are mounted securely. Said wear plates are to be constructed of a hardened steel alloy capable of withstanding high abrasion.

As illustrated in FIGS. **3** and **6**, the compression heads **46** and **47** are comprised of compression head frames **73** and **77**. Compression head wear plates **57**, **59**, **69** and **71** are securely mounted to said compression head frames as illustrated. Said wear plates are to be constructed of a hardened steel alloy capable of withstanding high abrasion.

The compression heads **46** and **47** are introduced within the compression case area **60** at opposite ends of said compression case and are secured by rear compression head plates **75** and **79** as seen in FIG. **6**. As can be seen in FIG. **3**, the rear compression head plates **75** and **79** are then attached to the hydraulic actuators **25** and **26** by means of actuator rods **31** and **32** at connection points generally designated by numerals **36** and **37**, respectively.

In reference to FIGS. **1**, **3** and **6**, as soil **51** is loaded into the soil hopper **17** by manual or mechanical means. At commencement of the "first stage" of operation, a high-frequency vibration apparatus **39** increases the force by which loose soil **51** passes downwardly through said soil hopper **17** and into an adjustable soil receiving area **49**. The downward force of the soil, aided by gravity and said vibration apparatus will uniformly fill and compact soil in said receiving area. At a preset interval of time the first stage of operation terminates as the PLC system **95** will disengage the high-frequency vibration apparatus **39**.

As can be seen in FIG. **3**, during the initial process, anterior hydraulic actuators **25** will be in fully retracted positions, while posterior hydraulic actuators **26** will be fully extended. Said actuators are coupled to anterior **46** and posterior **47** compression heads at connection points generally designated by numeral **37**. The positions of said actuators and respectively, said compression heads hereby aid in forming a soil receiving area **49**, which is adjustable in accordance to the positions of said compression heads within the compression case area **60**. In reference to FIG. **7**, as the "second stage" of operation begins, both anterior and posterior hydraulic actuators (not shown) engage the anterior compression head **46** and posterior compression head **47**. Said compression heads travel to preset destinations as shown in FIG. **7**. As is illustrated in FIG. **7**, the posterior compression head **47** will stop and remain stationary, as the anterior compression head **46** remains engaged. Thus, the "third stage" of operation begins. As the anterior compression head **46** travels within the compression case area **60** towards the posterior compression head **47** the soil **51** between said compression heads will become compacted further, until a block of compacted soil **10** is formed between said heads.

In reference to FIGS. **7** and **9**, the compression of the soil **51** between said compression heads will create a rise in hydraulic pressure in hydraulic line **118**. When an initial preset pressure is reached in said hydraulic line, an adjustable pressure switch **103** will engage, and the PLC unit **95** will actively engage valve assembly **106** to increase pressure in hydraulic line **112**. Hence, the posterior hydraulic actuator (not shown) will be engaged along with the posterior compression head **47** to travel towards the anterior compression head **46**. The dual compression of said compressed soil block will continue to elevate hydraulic pressure within hydraulic lines **112** and **118**. Upon reaching an optimal preset compression pressure in said hydraulic lines the adjustable pressure switch **104** will engage, and the PLC unit **95** will actively engage valve assembly **106** to disengage pressure in hydraulic line **112**, thus diverting the hydraulic pressure to hydraulic line **120**.

As illustrated on FIG. **8**, whereas a compressed soil block **10** has been successfully formed within the compression case area **60** by utilizing opposing compression heads **46** and **47**, the "fourth stage" of operation commences. As the posterior hydraulic actuator (not shown) retracts, the posterior compression head **47** is withdrawn to the position illustrated in FIG. **8**. As the anterior hydraulic actuator (not shown) continues through the compression case area **60**, the anterior compression head forces the compressed soil block **10** into the block discharge area **80**. Subsequent to the

completion of a fill operation, the discharged compressed soil block **10** will exit the invention. FIG. **8** generally illustrates the completion of the "fourth stage" of operation, and more specifically, the general locations of compression heads **46** and **47**. Whereas the "fourth stage" is completed, the hydraulic actuators **25** and **26** will return to their original 'base' positions. The PLC unit **95** will then re-engage the high-frequency vibrating apparatus **39**.

With attention now invited more specifically to FIG. **9**, it may be seen that the hydraulic actuators **25** and **26** are serially connected within a hydraulic circuit **108** including a pump **99** for pumping hydraulic fluid from a reservoir **29**, to the actuators **25** and **26** and then back to the reservoir **29**. The hydraulic circuit **108** includes valve assemblies **105** and **106** serially connected therein and the valve assemblies **105** and **106** are under the control of a pair of solenoids **107** and **109** actuated by output conductors **148**, **150**, **152**, **154**, **156**, **158**, **160** and **162**, from a PLC unit **95**. A plurality of proximity switches **90**, **91**, **92**, **93** and **94** are mounted stationary relative to the compression heads **46** and **47** and corresponding proximity switch actuators **83**, **84**, **85**, **87** and **89** are adjustably mounted on the positioning control apparatus **81**. In addition, adjustable pressure switches **103** and **104** are communicated with circuits **105** and **106** on the side thereof pressurized to extend the actuator rods **31** and **32**. The proximity switches **90**, **91**, **92**, **93** and **94** and pressure switches **103** and **104** are supplied current from a supply (not shown) and are connected to a PLC unit **95**. The pressure switches **103** and **104** including their own output lines **146** and **147**, respectively, comprising an input to PLC unit **95**. Similarly, the proximity switches **90**, **91**, **92**, **93** and **94** including their own output lines **140**, **142**, **144**, **136** and **138**, respectively, comprising an input to PLC unit **95**.

The valves **105** and **106**, actuated by the PLC unit **95** through output lines **148**, **150**, **152**, **154**, **156**, **158**, **160** and **162**, are operable to connect the output line **110** from the pump **99** to either the input lines **112**, **114**, **116** and **118** for extending the actuator rods **31** and **32** or lines **120**, **121**, **123** and **125** for retracting the actuator rods **31** and **32**. Of course, if the output line **110** from the pump **99** is communicated with lines **112**, **114**, **118** and **120**, lines **120**, **121**, **123** and **125** are communicated with the return lines **128**, **130**, **132** and **134** to the reservoir **29**. On the other hand, if the line **110** is communicated with lines **120**, **121**, **123** and **125**, lines **112**, **114**, **118** and **120** are communicated with the **128**, **130**, **132** and **134** to the reservoir **29**.

By removing the individual compression heads **46** and **47** from the compression case area **60**, individual working components of the apparatus may be readily renewed, if desired. Further, by utilizing variations of the compression case area **60** and compression heads **46** and **47**, the size and shape of the compressed soil blocks **10** to be formed may be varied.

Mounted on the frame are two support frames, **19** and **33**, which support the hopper **17** and multiple function cases generally designated by the numeral **27**.

As soon as the compressed soil block **10** is discharged onto the conveyor **35**, it is ready to use in the building process. With the use of the apparatus as depicted, the operator only has two tasks: first, to place soil into the hopper **17**, and second, to assemble the compressed soil blocks **10** into a structure.

The blocks **10** should be laid flat. After a course of blocks **10** has been laid, the upper flat surfaces of the blocks may be sprayed with water or mud slurry, so as to be slightly moistened when the next course of blocks is placed on it.

The embodiment of the invention as depicted can be summarized as follows. A plurality of linear multiple function cases. **27** and **28**, each having a soil receiving area **49**. The soil receiving area **49** is open vertically to the sky. The compression heads, **46** and **47**, are positioned as to provide the lateral walls within the soil receiving area **49**. The hopper **17** containing pre-granulated soil is mounted stationary above multiple function cases **27** and **28**. Mounted along the frame of the hopper is a vibration apparatus **39** which, when in operation along with gravity, feeds granulated soil into the soil receiving area **49** and in doing so, maximizing the soil density. This is most important for the production of high quality uniform building blocks.

When the hopper has filled the soil receiving area **49** the hydraulic actuators are activated, and the compression heads, **46** and **47**, move the soil within the multiple function case to its intended second stage location. It is at this second stage that the posterior compression head **47** remains in a fixed position momentarily while the anterior compression head **46** remains engaged and begins to lightly compact the soil **51**.

The soil compression process is completed during the third stage whereas the posterior compression head **47** is re-engaged to travel in the direction of the anterior compression head **46**. Simultaneously, the anterior compression head **46**, continues to press the soil in its travel towards the posterior compression head **47**. Hence, with the combined forces and relative applied pressure to the soil between said compression heads, the lightly compacted soil is compressed into a high density compressed soil block **10**.

During the following fourth stage, both compression heads, **46** and **47**, are moved within the multiple function cases, **27** and **28** toward the block discharge area **80**, at which the finished compressed soil block **10** falls away free of the trailer **15** and onto a conveyor system **35** for use.

The apparatus mounted on a heavy frame suitable to sustain the hydraulic forces of the hydraulic actuators **25** and **26** and compression heads, **46** and **47**.

While there is shown and described herein certain specific structure embodiments in the invention, it may be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described except insofar as indicated by the scope of the appended claims.

What is claimed is:

1. A method for the efficient forming of building blocks that are uniform in size and design from freshly dug soil by a self-enclosed linear process of receiving, moving, and compressing a quantity of soil to form said building blocks and ejecting said building blocks comprising:

controlling said size and design of said building blocks formed by said self-enclosed linear process using a programmable controller and operable mechanical means;

introducing said quantity of soil into a casing through a first aperture in an upper surface of said casing, wherein said casing comprises a plurality of sides and an enclosed cavity of adjustable dimensions, said cavity having two opposing faces formed from two opposing sides of said casing, wherein said two opposing sides are adjustable within the remaining sides of said casing for adjusting said dimensions of said cavity;

displacing said quantity of soil through said cavity in said casing to an area of compression within said casing by moving said two opposing sides;

compressing said quantity of soil within said casing between said two opposing sides by reducing said dimensions of said cavity to form said building blocks;

displacing said building blocks after compression to an ejection area within said casing by moving said two opposing sides; and

ejecting said building blocks from the bottom of said casing through a second aperture in a lower surface of said casing by allowing said building blocks to fall downwardly through gravity by increasing said dimensions of said cavity.

2. Method of claim **1**, wherein said opposing faces of said cavity are moved by said operable mechanical means.

3. Method of claim **1**, wherein said opposing faces of said cavity are controlled by an operable command means of said programmable controller, which command said opposing faces during said introducing, displacing, compressing and ejecting steps.

4. Method of claim **1**, wherein said quantity of soil is introduced into said casing by a vibration means.

5. An apparatus for efficient forming of building blocks that are uniform in size and shape from freshly dug soil comprising:

a casing having a plurality of sides, said casing comprising at least one first aperture in an upper surface of said casing for the introduction of a quantity of soil, at least one second aperture in a lower surface of said casing for the ejection of said building blocks, and an enclosed cavity of adjustable dimensions defined by said plurality of sides, wherein two opposing sides of said casing are adjustable within the remaining sides of said casing for adjusting said dimensions of said cavity, said two opposing sides of said casing traveling within the entirety of said casing and creating sufficient pressure against one another for the compression of said quantity of soil;

means for compressing said quantity of soil within said casing to specific pressures between said two opposing sides to form said building blocks;

means for moving said two opposed sides within said casing between areas of introduction, compression and ejection within said casing;

means for ejecting said building blocks from the bottom of said casing through said at least one second aperture by moving said two opposing sides apart such that said building block falls downwardly by gravity after compression; and

a programmable controller that controls said size and design of said building blocks by controlling said introduction, means for compressing, means for moving and means for ejecting whereby consistent compression is imposed on said quantity of soil.

6. Apparatus of claim **1**, wherein the apparatus comprises a trailer which is wheeled, and mobile, and is of a size and nature such that it can be towed on roads, and can be maneuvered about a construction site.

7. Apparatus of claim **5**, wherein the apparatus comprises a casing having six sides through which two opposing faces of said two opposing sides travel within said casing for the purpose of receiving, displacing, and compressing said quantity of soil and ejecting said building blocks.

8. Apparatus of claim **5**, wherein the apparatus comprises a casing cylindrical in nature through which two opposing faces of said two opposing sides travel within said casing for the purpose of receiving, displacing, and compressing said quantity of soil and ejecting said building blocks.

9. Apparatus of claim **5**, wherein the apparatus comprises a soil hopper.

10. Apparatus of claim **5**, wherein a plurality of said casings are fastened to one another with the purpose of creating a higher volume of compressed building blocks simultaneously that are uniform in size and design.

11. Apparatus of claim **5**, wherein a plurality of said casings of varying dimensions may be fastened to one another with the purpose of creating compressed building blocks simultaneously that are varied in size and design.

12. An apparatus for the efficient forming of building blocks that are uniform in size and design from freshly dug soil by a self-enclosed linear process of receiving, moving, and compressing a quantity of soil to form said building blocks and ejecting said building blocks comprising:

means for controlling said size and design of said building blocks formed by said self-enclosed linear process using a programmable controller and operable mechanical means;

means for introducing said quantity of soil into a casing through a first aperture in an upper surface of said casing, wherein said casing comprises a plurality of sides and an enclosed cavity of adjustable dimensions, said cavity having two opposing faces formed from two opposing sides of said casing, wherein said two opposing sides are adjustable within the remaining sides of said casing for adjusting said dimensions of said cavity;

means for displacing said quantity of soil through said cavity in said casing to an area of compression within said casing by moving said two opposing sides;

means for compressing said quantity of soil within said casing between said two opposing sides by reducing said dimensions of said cavity to form said building blocks;

means for displacing said building blocks after compression to an ejection area within said casing by moving said two opposing sides; and

means for ejecting said building blocks from the bottom of said casing through a second aperture in a lower surface of said casing by allowing said building blocks to fall downwardly through gravity by increasing said dimensions of said cavity.

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